

REMARKS

Claims 1, 3-17, 19-25, 27-34, 36-40, 42, 43, 45, 46, 48, 49, 51-58, 60-63, and 65-92 are pending in the application. Claims 1, 3-5, 17, 19, 24, 25, 27, 31, 32, 34, 36, 40, 58, 60-63, 65-69, and 71-92 stand rejected. Claims 6-16, 18, 20-23, 26, 28-30, 33, 35, 37-39, 41-57, 59, 64, 70, and 74 stand objected to.

Before responding to the specific rejections, Applicants believe that a brief discussion of the Applicants' claimed invention may be useful.

Dual-Tone Multiple-Frequency (DTMF) signals include sinusoids located between 0 Hz and less than 2 kHz. Applicants identified that it is possible to reduce the sampling frequency of a once-decimated digital signal from 4 kHz to 2 kHz and still detect the DTMF sinusoids. This is recited in Claim 17 ("a splitter to separate an electrical signal . . . into subbands of 0-1 kHz and 1-2 kHz being at a sampling frequency of less than twice the highest frequency used to encode dialed digits"). Thus, for a system detecting DTMF signals, the subband signals output by the splitter span between 0 Hz and less than 2 kHz. This reduction in sampling frequency allows filters following the splitter to operate at 2 kHz instead of 4 kHz, thereby conserving bandwidth for increased DTMF detector density.

As is true of any sampling frequency system, aliasing may occur as a result of sampling, decimation, or other discrete-time operation. Applicants teach use of an efficient band-split filter, having low- and high-pass filter characteristics described by the frequency responses of Fig. 6, that performs the 4 kHz to 2 kHz sample rate reduction and prevents aliasing of the 1-2 kHz DTMF signals with the 0-1 kHz DTMF signals (i.e., prevents the 1-2 kHz DTMF signals from "appearing" as 0-1 kHz signals and the 0-1 kHz DTMF signals from "appearing" as 1-2 kHz DTMF signals).

Remarks Regarding Rejections under 35 U.S.C. § 102(b)

Claims 1, 6, 12, 13, 15-17, 24, 25, 31, 32, 34, 40, 58, 63, 68, 69, 73, 77, 78, 81, 82, 85, 86, 89, and 90 were rejected under 35 U.S.C. § 102(b) as being anticipated by Canniff et al. (U.S. Pat. No. 5,619, 564) (hereinafter "Canniff").

In contrast to Applicants' Claim 17, the Canniff reference discloses a detector that includes a decimator that decimates a sampled 8 kHz analog signal to 4 kHz. The downsampled

data is high-pass filtered to remove power line frequency components at 60 Hz, harmonics thereof, and a dial tone (Col. 3, lines 34-38). The sampling frequency of the signal downstream of the high-pass filter is 4 kHz. Therefore, a high tone band elimination filter and a low tone band elimination filter that follow the high-pass filter operate at 4 kHz, which is twice the frequency of the highest frequency of the DTMF sinusoids.

The high and low tone band elimination filters remove high and low frequencies, respectively. However, the sampling frequencies downstream of the band elimination filters remain at 4 kHz, as disclosed in Col. 4, lines 3-5 (“[t]he bandpass filtered output signals from bandpass filters BPF1-BPF8 . . . are generated at a 4 kHz rate.”).

Following the bandpass filters in the Canniff detector of Fig. 1, a downsampler decimates the 4 kHz signals to 1 kHz signals. The downsampler does not separate or split the signal into subbands of 0-1 kHz and 1-2 kHz, nor is the output of the downsampler a frequency of less than twice the highest frequency (i.e., 2 kHz) of the dialed digits. Therefore, the Canniff reference does not disclose the Applicants’ invention as recited in Claim 17 (“a splitter to separate an electrical signal . . . into subbands of 0-1 kHz and 1-2 kHz being at a sampling frequency of less than twice the highest frequency used to encode dialed digits”).

Moreover, if the detector disclosed by Canniff in Fig. 1 were presented with a 4 kHz sampled signal at the decimator to produce a 2 kHz sampled signal, an aliased signal would result due to a lack of low-pass filtering prior to or as part of the decimator. Thus, the Canniff detector would not be able to detect DTMF digits reliably.

Accordingly, because the Canniff reference does not teach every claim limitation of Applicants’ Claim 17, Applicants respectfully submit that the rejection under 35 U.S.C. 102(b) should be withdrawn.

Because independent Claims 1, 25, 32, 34, 40, 58, 63, 68, 69, 73, 77, and 81 include similar claim limitations, the rejection should be removed for these claims for similar reasons.

Dependent Claims 6, 12, 13, 15, 16, 24, 31, 78, and 82 should also be allowed under 35 U.S.C. 102(b) for at least the same reasons.

Independent Claim 85 includes limitations (“rate change splitting the electrical signal into subbands . . . using a power symmetric infinite impulse response (PS-IIR) filter”) that are not shown or described in the Canniff reference. For example, Canniff discloses high and low tone

band elimination filters and bandpass filters that generate output signals at a 4 kHz rate and a downsampler that decimates the 4 kHz output signals from the bandpass filters to 1 kHz signals (see Canniff, Fig. 1, BPF1-BPF8 and reference nos. 16, 18, and 32). Accordingly, Applicants respectfully submit Claim 85 should be allowed.

Independent Claim 89 includes similar limitations (“a splitter that separates and decimates an electrical signal into subbands . . . comprising a power symmetric infinite impulse response (PS-IIR) filter”). Accordingly, Applicants respectfully submit that Claim 89 should be allowed for the same reason as Claim 85.

Dependent Claim 86 depends from Claim 85 and Dependent Claim 90 depends from Claim 89. Accordingly, the dependent claims should be allowed for at least the same reasons as the independent claims from which they depend.

Remarks Regarding Rejections under 35 U.S.C. § 103

Claims 3-5, 19, 27, 36, 60-62, 65-67, 71, 72, 75, 76, 79, 80, 83, 84, 87, 88, 91, and 92 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Canniff in view of Applicants’ admitted prior art.

Claims 3-5 depend from Claim 1; Claim 19 depends from Claim 17; Claim 27 depends from Claim 25; Claim 36 depends from Claim 34; Claims 60-62 depend from Claim 58; Claims 65-67 depend from Claim 63; Claims 71 and 72 depend from Claim 69; Claims 75 and 76 depend from Claim 73; Claims 79 and 80 depend from Claim 77; Claims 83 and 84 depend from Claim 81; Claims 87 and 88 depend from Claim 85; and Claims 91 and 92 depend from Claim 89. Thus, the foregoing arguments apply. Therefore, because the rejection under 35 U.S.C. § 103(a) is not being applied against the independent claims, the dependent claims should be allowed for at least the same reasons.

CONCLUSION

In view of the above amendments and remarks, it is believed that all claims are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned.

Respectfully submitted,

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